Edd Clark & Associates, Inc.
Environmental Consultants

February 21, 2008
Job No. 0268,002.96

Ms. Judith Brown
669 Congo Street
San Francisco, CA 94131

Remedial Action Plan
18460 Sonoma Highway
Boyes Hot Springs, California

Dear Ms. Brown:

Please accept this as Edd Clark & Associates, Inc.'s (EC&A's) Remedial Action Plan (RAP) for 18460 Sonoma Highway (site) in Boyes Hot Springs, California (Figure 1). In a letter dated July 31, 2000, the County of Sonoma Department of Health Services (CSDHS) requested that a Feasibility Study/Corrective Action Plan (FS/CAP) be prepared for the site to review past regional and site-specific data and identify the most cost-effective and technologically feasible method to remediate soil and groundwater impacted by fuel hydrocarbons (FHCs) from underground storage tanks (USTs) formerly located at the site.

With the approval of the CSDHS, submittal of an FS/CAP was deferred until the plume of FHCs was adequately defined. In addition to the FHC release, there was a release of halogenated volatile organic compounds (HVOCs) from a dry cleaner formerly operating at the site. Before the FS/CAP could be completed it was necessary to evaluate the HVOC plume because there was interference between the FHC analyses and HVOC analyses, which resulted in false-positive, elevated FHC concentrations that obscured the detection of low concentrations of the volatile components of gasoline. Additionally, the HVOC plume impacts remediation options for the FHC release.

EC&A's May 29, 2007 FS/CAP recommended high-vacuum dual-phase extraction (HVDPE) and ozone microsparging with hydrogen peroxide to remediate FHC-impacted soil and groundwater at the site, and proposed conducting HVDPE and ozone/hydrogen peroxide pilot tests to assess the potential for these methods to be effective remedial methods. In their letter dated June 28, 2007, the CSDHS concurred with these recommendations and requested submittal of a RAP to provide details for implementing the proposed scope of work. A copy of this RAP will be submitted to the CSDHS for their review and approval.

This RAP includes the following proposed tasks:

- Conducting slug tests on selected site monitoring wells and preparing a report evaluating the results of the slug test;
- Performing a four- to six-hour HVDPE pilot test on MW-2 and preparing a report evaluating the results of the pilot test;

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- Performing a three-month pilot test for the injection of chemical oxidants ozone and hydrogen peroxide to the shallow aquifer including the installation of three dual-point injection wells to approximately 30 feet (ft) below ground surface (bgs);
- Preparing a report of the three-month ozone and hydrogen peroxide injection pilot test; and
- Continuing quarterly groundwater monitoring and sampling of the existing monitoring wells.

BACKGROUND

Site Description

The site is located in a light-commercial and residential land-use area, is paved with asphalt and is relatively flat. The ground surface slopes gently to the west and north. There is a small creek located about 75 yards north of the site that flows to the west. The nearest cross street is West Thompson Avenue. A one-story commercial building currently occupies the site (Figure 2). Reportedly, the building was occupied by a dry cleaning business for 10 to 20 years until about 1993, after which time a motorcycle-repair shop occupied the building until about 1998. Currently, PC Metro, a cell phone business, occupies part of the building.

The property adjacent to the west of the site is occupied by an apartment building and parking lot; to the east is Sonoma Highway. The property to the north is occupied by Bragg's Plumbing & Heating, a party-supply store, and two residential buildings that front on Mulford Lane. The property to the south is occupied by a produce market. Sewer and water services at site and site vicinity are provided by the County of Sonoma and the Valley of the Moon Water District, respectively.

Two 1000-gallon USTs for gasoline were formerly located between the east side of the commercial building and Sonoma Highway. This location is approximately 18 ft from the highway (Figure 3). There are numerous underground utilities in the immediate area. The western end of the USTs that formerly occupied the site extended approximately 4 ft under the onsite structure. The location of the former USTs is paved with asphalt.

A dry cleaning facility was formerly located in the northwest corner of the building. A floor drain located near the middle of the north wall of the building in a small room adjacent to the former dry cleaning facility is suspected to be the location of a tetrachloroethene (PCE) release. The floor drain connects to a sewer line that extends along the north wall of the building. Effluent from a toilet and sink in the onsite building also entered the sewer line . Near the northeast corner of the building, the sewer line formerly turned to the northwest and extended beneath the Braggs Plumbing & Heating building to join the Mulford Street sewer line near monitoring wells MW-8/MW-8D. According to Barry Hines, a realtor who represents the site owner, when the sewer lines were inspected in August 2004, the line to Mulford Street was found to have been invaded by tree roots. On March 15 and 16, 2006, EC&A observed abandonment of the sewer line under the Braggs Plumbing & Heating building. A new line was installed that carries effluent from the site to the Mulford Street sewer line without going under the Braggs Plumbing & Heating building (Figure 3).

Previous Site Investigations and Groundwater Monitoring

- August 1995 UST Removal - On August 16, 1995, the Fuel Oil Polishing Company (FOPCO) uncovered and inerted two 1000-gallon USTs for gasoline. The USTs were rusted and pitted and a slight petroleum hydrocarbon odor was observed from the excavation and backfill material. The USTs were not removed from the excavation because their removal would have undermined the building foundation. At the request of the CSDHS, samples of soil were collected from the excavation floor and from soil removed from the excavation, and samples were collected of water that entered the open excavation on August 16, 1995.

- October 1995 Over-excavation - The location of the former USTs was over-excavated by FOPCO on October 18, 1995. Prior to removing FHC-impacted soil, the portions of the USTs that were not beneath the building foundation were cut and removed from the excavation and transported to a recycling facility. Two approximately 4 ft-long by 4 ft-wide sections of the USTs were left beneath the building. Stockpiled soil was disposed of offsite.

- November 1997 Soil and Groundwater Investigation - To delineate the lateral and vertical extent of FHC-impacted soil and assess the impact to groundwater in the location of the former USTs, EC&A directed the installation of six soil borings (B-1 through B-6) at the locations indicated on Figure 3.

- March and April 1999 Groundwater Investigation - On March 31 and April 1, 1999, EC&A directed the installation of MW-1, MW-2 and MW-3 to depths of 25 ft, 20 ft and 25 ft, respectively (Figure 2).

- August 1999 Sensitive Receptor Survey - In August 1999, EC&A conducted a Sensitive Receptor Survey (SRS) in the site vicinity. The search parameters for the SRS were petroleum vapor receptors within a 250 ft radius of the site, groundwater plume receptors within 750 ft and municipal wells within one-half mile. The SRS was performed by observation and inspection of properties within the search radius and questioning property owners when possible. The results of the SRS were transmitted to the CSDHS in EC&A's September 7, 1999, *Monitoring Well Installation/Groundwater Sampling Event/Sensitive Receptor Survey Report*.

- May and June 2000 Additional Sensitive Receptor Surveys - On May 8, 2000, EC&A personnel received well log information from the Department of Water Resources (DWR). As a follow-up to receipt of the DWR report, EC&A performed a site and area reconnaissance on June 28, 2000 to observe and document area topography and the location and usage of domestic wells within the vicinity of the site. The results of the additional SRS were submitted to the CSDHS in a letter dated October 19, 2000.

- June and September 2003 Soil and Groundwater Investigation - To further evaluate the lateral and vertical extent of FHC- and VOC-impacted groundwater in the vicinity of the former USTs, EC&A directed the advancement of one exploratory soil boring, six shallow groundwater monitoring wells and one deep groundwater monitoring well in June and September 2003, and

collected soil and groundwater samples for chemical analyses. In June 2003, shallow groundwater monitoring wells MW-4, MW-5 and MW-6 were installed. In September 2003, exploratory soil boring B-7, shallow groundwater monitoring wells MW-7, MW-8 and MW-9, and deep groundwater monitoring well MW-8D were installed.

- April 2005 Soil Gas Survey - On April 14 and 15, 2005, EC&A conducted a soil gas survey to assess the possibility of another source of PCE and/or other VOCs in the area between MW-6 and MW-9, and establish whether sewer lines have served as a preferential pathway for the migration of VOCs. Soil gas sample analytical results confirmed that there was a release of PCE (and associated degradation products) at the site, there does not appear to be another source of PCE impacting soil and groundwater at the site, and in the site vicinity, sewer lines have served as a preferential pathway for the migration of solvent VOCs. FHC concentrations detected offsite are probably due to releases from automobiles. The sewer line does not appear to be a significant source of TPH or BTEX impacts. The detection near MW-2 is likely due to the release from the former USTs; the detection in the parking lot in front of the apartment building could be from a release from the former UST or from automobiles.

- March 2006 Sewer Line Replacement - On March 15 and 16, 2006, the sewer line serving the site was abandoned and replaced by a new line. The old line was found to be nearly plugged by tree roots. The new line connects with the Mulford Street sewer near MW-8. The locations of both lines are shown on Figure 3. PCE was detected in a soil sample collected from the bottom of the clay layer encountered and in soil stockpile samples.

- April 1999 through December 2007 Groundwater Monitoring - All groundwater samples collected during the sampling events were analyzed for total petroleum hydrocarbons (TPH) as gasoline (g) and benzene, toluene, ethylbenzene and xylenes (BTEX). Groundwater samples have also been analyzed for methyl tert-butyl ether (MTBE) and other oxygenates and the lead scavengers ethylene dibromide (EDB) and 1,2-dichloroethane (1,2-DCA). Since February 2002, the samples from all wells have also been analyzed for VOCs by full scan EPA Method 8260. At EC&A's request, since January 2005, the analytical laboratory subtracted the TPHg-range non-target peaks from the TPH analysis for MW-6 and MW-9 because previous TPH test results for these wells were annotated by the analytical laboratory as "one to a few isolated non-target peaks present," which at this site typically indicates the presence of solvents.

A detailed history of the soil and groundwater investigations and a summary of FHC- and HVOC-impacted soil and groundwater conditions are provided in EC&A's May 29, 2007 FS/CAP.

SOIL AND GROUNDWATER REMEDIAL ACTION WORKPLAN

EC&A's May 29, 2007 FS/CAP selected HVDPE and ozone sparging with hydrogen peroxide injection to remediate FHC-impacted soil and groundwater at the site, and recommended conducting HVDPE and ozone/hydrogen peroxide pilot tests to assess the potential for these methods to be

effective remedial methods. HVDPE would be useful to reduce the high concentrations of FHCs remaining in soil in the vadose zone near the location of the former USTs, including beneath the building. Lowering the concentrations of TPHg and BTEX in soil would dramatically reduce the time needed for ozone sparging with hydrogen peroxide injection to remediate the site. Additionally, ozone sparging and hydrogen peroxide injection would also remediate HVOC-impacted groundwater that is beneath the site. Pilot tests were recommended for both remedial alternatives because low-permeability soils beneath the site could limit the effectiveness of these alternatives, and HVOCs in groundwater beneath the site could damage the HVDPE equipment and pose a serious health safety problem. In addition to the HVDPE and ozone and hydrogen peroxide injection pilot tests, EC&A's FS/CAP recommended performing a slug test on selected onsite monitoring wells to provide data for injection- and/or extraction-well design and spacing.

This workplan describes EC&A's proposed scope of work for conducting a slug test, four- to six-hour HVDPE pilot test, and a three-month ozone and hydrogen peroxide injection test. The proposed scope of work is presented below by Task.

Task 1 - Project Management, Client and Agency Communications
This task includes administrative services, project planning, scheduling, and client and regulatory agency communications and meetings concerning the slug and pilot tests and groundwater monitoring for one year.

Task 2 - Permitting/Access Agreements/ Utility Location
A remediation well installation permit for the three proposed ozone and hydrogen peroxide injection wells will be acquired from the CSDHS. This task includes preparation and submittal of the permit application and communications with permitting agency representatives. The CSDHS will be notified at least 48 hours prior to drilling.

An underground utility locator service will be employed to clear boring and trenching locations within the site boundaries. The drilling and trenching locations will also be marked for Underground Service Alert (USA) and USA will be notified at least 48 hours prior to drilling.

Task 3 - Slug Tests
EC&A will conduct slug tests in monitoring wells MW-1, MW-2, MW-3 and MW-6 to evaluate the hydraulic properties of the shallow alluvium. These wells represent locations within the contaminant footprint and will be the most useful for hydraulic analysis. Hydraulic data obtained from the wells will be used to evaluate future sparge well design and spacing. A slug test is conducted by removing a slug of water to lower the water level from its original equilibrium level and measuring the rate of water-level recovery. Water-level changes are measured with a pressure-sensitive transducer and recorded on a laptop computer.

Slug Test Procedures

- Open the wells 24 hours before the test to allow adequate time for them to equilibrate.

- Measure the static water level in each well before disturbing the water column or placing any equipment in the well.
- Measure and record the total depth of the well.
- Place a transducer in the well to the appropriate depth (see depth limits for individual transducers, or manufacturers specifications). Do not place a transducer so that its range will be exceeded or so that the transducer interferes with the movement of the slug.
- Place a slug of precisely known volume in the well above the transducer. Use a slug of small enough length to be removed in one continuous stroke; a 3-ft-long slug is usually appropriate. The slug should produce over 0.5 ft of draw-down.
- When the water level has returned to static height, initialize the data logger.
- Remove the slug quickly and smoothly. Use the auto-start feature to start the data logger.
- The test may be terminated after recovery is complete, or after 10 to 15 minutes for wells with slow recovery. Ideally, recovery measurements should be continued until a good percentage of total recovery is attained. If feasible, about 75% of full recovery should be attempted.

Task4 - HVDPE Pilot Test

A four- to six-hour HVDPE pilot test will be performed on MW-2, the well in which the greatest FHC concentrations in groundwater have been detected. The objectives of this test are to assess vapor yields from the shallow water-bearing zone and the potential for PCE vapors and/or PCE-impacted groundwater to migrate into possible future extraction wells. Additionally, aquifer draw-down data will be collected from the surrounding monitoring wells to evaluate the radius of influence in MW-2 and to calculate transmissivity values that can be compared to hydraulic conductivity values obtained from the slug test.

The primary concern for the use of HVDPE at the site is the risk exposure to hydrochloric acid (HCl) vapors and secondarily, the potential damage to the HVDPE equipment from HCl. HCI is formed when PCE passes through the thermal oxidizer of the HVDPE equipment. PCE concentrations in MW-2 have fluctuated between non-detect (ND) <25 µg/l and 780 µg/l. CalClean Inc., of Tustin, California (CalClean), the subcontractor who would perform the pilot test, reported that given the reported PCE concentrations in groundwater and the short duration of the pilot test, a four- to six-hour pilot test should not pose a health risk or damage the HVDPE equipment.

Under the supervision of EC&A personnel, CalClean will conduct a four- to six-hour pilot test using a low-noise, truck-mounted 450-cubic-ft-per-minute (CFM) high-vacuum liquid ring blower, along with a propane-fired oxidizer. MW-2, which is constructed with 2-inch PVC casing and is screened from 10 ft to 20 ft bgs with 0.01inch slotted PVC casing, will be used as an extraction well. Vacuum and groundwater draw-down levels will be measured in monitoring wells MW-1, MW-3, MW-5 and MW-6. Up to 1100 gallons of extracted groundwater will be pumped into a 1100-gallon storage tank. When the pilot test is over, the contents will be tested and disposed of in an appropriate manner. Disposal documentation will be provided to the CSDHS.

During the pilot test, an Horiba MEXA-324JU field analyzer, calibrated as hexane, will be used for field measurements of influent hydrocarbon concentrations. An influent vapor sample will be

collected within 15 minutes of the startup of the HVDPE equipment and every two hours thereafter for a total of four samples, assuming a six-hour pilot test (three samples for a four-hour pilot test). A stack sample will also be collected after the HVDPE equipment has run for approximately 15 minutes.

All influent vapor samples will be analyzed for TPHg and VOCs, basic target list including fuel oxygenates, by Analytical Methods 8015/SW8260B. Vapor samples will collected in Tedlar bags and submitted under chain of custody procedures to a State-certified laboratory for analysis.

Following the pilot test, a brief report will be prepared which will evaluate the radius of influence of the extraction well, the quantity of FHCs that can be extracted by the HVDPE, and whether using HVDPE at the site will result in a health risk and/or damage to the HVDPE equipment from HCI vapors. The report will be electronically submitted to the State GeoTracker Internet Database.

If the results of the pilot test and slug tests are favorable for HVDPE, and the results of the ozone and hydrogen peroxide injection pilot test are not favorable, EC&A will prepare a RAP Addendum for installing three 4-inch-diameter extraction wells at locations near the southeast corner of the building and conducting a 30-day HVDPE event.

Task 5 - Ozone and Hydrogen Peroxide Injection Pilot Test

A three-month pilot test will be conducted at the site to evaluate the effectiveness of ozone and hydrogen peroxide injection in remediating impacted soil and groundwater. EC&A recommended a pilot test because subsurface materials consisting of very dense silty-sand and hard sandy-silt with significant gravel content in some intervals may not allow for effective distribution of oxidants within subsurface materials, and may result in injection pressures that could damage the injection equipment or result in short circuiting of ozone to the ground surface. Three dual-completion ozone/hydrogen peroxide injection wells will be installed to conduct the pilot test. The injection wells will be installed to approximately 30 ft bgs within the sand/silt unit. The pilot test will be conducted using a PulseOx 100 ozone/hydrogen peroxide unit supplied by Applied Process Technology, Inc., (APT) of Pleasanton, California, or equivalent unit.

Injection Well Installation

EC&A proposes to install three dual-point ozone/hydrogen peroxide injection wells (SP-1, SP-2 and SP-3) on 20-ft centers, in the locations shown on Figure 3. The ozone/hydrogen peroxide sparge points will be installed no closer than 10 ft horizontally from nearby underground utilities and existing monitoring well locations to preclude potential ozone damage to the underground utilities and to minimize the potential of short circuiting in the nearby monitoring wells.

The well borings will be drilled with a truck-mounted drill rig equipped with 10-inch-outside-diameter, hollow-stem augers. Drilling will be performed under the technical direction of an EC&A field geologist who will classify the soils encountered, maintain a continuous log of the lithology and assist with collection of soil samples. All field work will be performed under the supervision of a California-registered geologist. EC&A personnel will field screen the breathing zone and soil

samples for organic vapors with a photo ionization detector (PID). Soil samples will be collected for field screening and logging purposes only.

Sparge wells SP-1, SP-2 and SP-3 will be completed as nested sparge wells for the injection of ozone and hydrogen peroxide.

Soil Sample Collection

Soil samples will be collected from the borings sampled at 5 ft, 10 ft, 15 ft bgs, and continuously from 20 ft bgs to the total depth to ensure that the points are installed in permeable materials. The soil samples will be collected using a split-spoon sampling apparatus containing 2-inch-diameter by 6-inch-long brass liners. When a boring is advanced to the selected sampling depth, the drill rods will be withdrawn from the boring and the sampler will be lowered into the bottom of the hole and driven approximately 18 inches into soil ahead of the auger with a 140-pound, drill-rig-operated hammer. Soil samples will be used for logging purposes only and will not be submitted for laboratory analyses.

Grab-groundwater Sample Collection and Analysis

One grab-groundwater sample will be collected from each well boring by lowering a new disposable bailer into the borehole. The groundwater sample will be transferred from the bailer into laboratory-supplied, sterile sample containers, logged on a chain-of-custody document, placed on ice and transported to a State-certified laboratory for chemical analyses. All samples will be analyzed for TPHg and BTEX by Analytical Methods SW8015Cm/8021B, and for VOCs, basic target list including fuel oxygenates, by Analytical Method SW8260B. The results of the sample analyses will be electronically submitted to the State GeoTracker Internet Database.

Sparge Well Construction

Dual-point injection wells SP-1, SP-2 and SP-3 will be constructed for the injection of ozone and hydrogen peroxide solution into the shallow aquifer. The ozone injection points will be installed near the bottom of the sparge well; the hydrogen peroxide solution injection points will be installed approximately 3 ft above the top of the ozone points. An injection point will be installed at approximately 20 ft to25 ft bgs to inject a hydrogen peroxide solution, and an injection point will be installed at approximately 25 ft to 30 ft bgs to inject ozone. The actual depths of the injection points will be determined in the field based on the observed permeability of soil conditions.

The injection points will either be ½-inch 304 stainless steel sparge points (1-ft-long points for hydrogen peroxide injection and 3-ft-long for ozone injection) affixed to ½-inch stainless steel risers, or porous (25 micron pore) Kynar 1.5-inch-diameter by 1.5-ft-long sparge points affixed to 1-inch-inside-diameter Schedule 80 PVC risers with Viton® o-rings. The risers for the injection points will extend from the top of each injection point to approximately 0.5 ft bgs to allow adequate space for connection of the delivery lines.

Prior to installation of the sparge point and risers, a bed of at least 6 inches of #2/16 sand will be placed at the bottom of each well boring and in the annular space between the borehole wall and

injection point. In each injection well, the hydrogen peroxide solution injection points will be installed with a minimum 3-ft separation between the tops of the ozone point and the bottom of the peroxide point. An approximately 3-ft-thick layer of bentonite chips will be placed between the lower and upper points and hydrated. Sand will extend approximately 1 ft above and below the lower point, and 3 ft to 5 ft above the upper point. A minimum 3-ft-thick seal of bentonite chips will be placed above the sand pack above hydrogen peroxide injection point and hydrated. Cement grout will be added in each well to approximately 6 inches below grade.

An 18-inch-diameter, traffic-rated well box will be installed and set in concrete to protect the top of each injection well after the well-head plumbing is completed. Each injection well will be isolated from the rest of the system by a one-way check-valve in the well box. A typical sparge well construction diagram is shown on Figure 4. Figure 5 shows well head construction details.

Equipment Decontamination and Waste Storage

In order to minimize the possibility of cross contamination, all down-hole drilling and sampling equipment will be decontaminated prior to use. Down-hole drilling equipment will be pressure washed between borings. Sampling equipment will be washed in a low-phosphorous, soap-and-water solution and double rinsed with tap water before samples are collected. Soil from the well borings will be placed in either properly labeled DOT 17-H 55-gallon drums or a soil bin for temporary, onsite storage. Water from equipment decontamination will be placed in properly labeled DOT 17-H 55-gallon drums for temporary, onsite storage. Both waste soil and water will be characterized for disposal. Waste disposal documentation will be provided to the CSDHS.

System Plumbing and Trenching Construction

A network of plumbing trenches will be excavated to approximately 18 inches bgs for the installation of ozone and hydrogen peroxide delivery piping to the individual sparge points (Figure 3). Where required, the surface will be saw-cut to remove the asphalt or concrete pavement. Ozone gas will be delivered from the ozone generator panel through individual, ½-inch-outside-diameter by ⅜-inch-inside-diameter Teflon® tubing. The hydrogen peroxide delivery line will consist of ¼-inch polypropylene (LLHDPE) tubing. Both the ozone and hydrogen peroxide delivery tubing will be housed within a 2-inch-outside-diameter conveyance conduit (Figure 5). One-way stainless steel check valves will be installed in each well-box housing and on each line at the panel to prevent a release of ozone or hydrogen peroxide to the atmosphere. The delivery piping will be buried approximately 18 inches bgs and bedded in and covered with sand to a depth of approximately 4 inches. The trench will be backfilled above the bedding sand with native fill and, *if necessary,* Class 2 aggregate base over the native backfill.

The surface will then be repaired to its previous condition. Upon trenching completion, the piping and tubing will be connected to the sparge wells prior to setting the weather-tight, traffic-rated well boxes in concrete grout. A typical sparge well piping construction diagram is shown in detail on Figure 5.

Ozone Generator and Hydrogen Peroxide Injection Units

EC&A will install one 3-point PulseOx 100 ozone/hydrogen peroxide unit supplied by Applied Process Technology, Inc. (APT) of Pleasanton California, or equivalent unit. The APT system is a compact, trailer-mounted unit consisting of a NEMA 3R cabinet with UL-rated parts, an enclosed ozone generator and a 25-gallon, double-walled tank for the hydrogen peroxide injections. The system is weather resistant and is air cooled by factory-installed fans.

In addition to the ozone/hydrogen peroxide unit, the system includes an oil-less air compressor. The sparge wells will be supplied by an ozone generator equipped to supply up to 23 scfh at 95% oxygen and deliver up to 2 pounds of ozone and 12 gallons per day of pulsed, approximately 7% hydrogen peroxide solution. System electrical requirements include two115-volt, single-phase, 60-Hz (15/20 amp) services for the ozone and hydrogen peroxide system, fan assembly and general electrical outlet requirements. An ozone-process and instrumentation-system diagram is shown as Figure 6. The system (Panel A) will be housed in an enclosure constructed with a locking gate at a location to be chosen by the property owner.

System Startup

The system will be started up on a Wednesday or earlier so that the panel can be inspected for the first three consecutive days of operation. Upon startup, the system will be checked for leaks by applying a soap-and-water solution to system components and plumbing connections and inspecting for bubbles or other evidence of leakage. Additionally, the ozone generator and sparge well heads will be checked with an OMC-1108 Portable Ozone Monitor capable of detecting ozone from 0.01 ppm to 9.99 ppm. The system will be checked daily for three days following system startup.

Operation and Maintenance (O&M)

Following startup, the system will be checked once per week for the first month and monthly thereafter to ensure that ozone and/or hydrogen peroxide injection is in progress and the injection system is programed for optimum oxidant delivery. During each O&M visit, the panel, well heads and accessible plumbing will be checked for ozone leaks with an OMC-1108 Portable Ozone Monitor capable of detecting ozone from 0.01 ppm to 9.99 ppm. During monthly O&M visits, dissolved oxygen (DO) measurements only will be taken from MW-1 through MW-6. These wells will not be purged prior to collecting measurements.

Pilot Test Report Preparation

Following the pilot test, a report evaluating the effectiveness of ozone/hydrogen peroxide injection will be prepared. The report will be electronically submitted to the State GeoTracker Internet Database. If ozone/hydrogen peroxide injection is an effective remediation technology for the site, EC&A will prepare a RAP Addendum to install a full system that will operate for several years.

Task 6 - Groundwater Monitoring Program

Pre-ozone/Hydrogen Peroxide Injection Pilot Test Baseline Sample Event

To establish baseline groundwater conditions prior to the pilot test, EC&A will collect post-purge DO and oxidation-reduction potential (ORP) measurements from all of the monitoring wells.

Samples will be collected from all of the monitoring wells and analyzed for TPHg (with non-target peaks subtracted), BTEX and HVOCs. MW-1 through MW-6 will also be analyzed for ORP-sensitive chemicals inorganic anions bromide and bromate, and dissolved metals hexavalent chromium, vanadium, selenium and molybdenum.

Post-ozone/Hydrogen Peroxide Injection Pilot Test Sample Event

Following the pilot test, post-purge DO and ORP measurements will be collected from all of the monitoring wells. Samples will be collected from all of the monitoring wells and from the injection wells and analyzed for TPHg (with non-target peaks subtracted), BTEX and HVOCs. Samples from MW-1 through MW-6 will also be analyzed for ORP-sensitive chemicals inorganic anions bromide and bromate, and dissolved metals hexavalent chromium, vanadium, selenium and molybdenum.

Quarterly Groundwater Monitoring

Quarterly groundwater monitoring will be resumed three months following the post pilot test sample event. All of the monitoring wells will be sampled and analyzed for TPHg (with non-target peaks subtracted), BTEX and HVOCs. Post-purge DO and ORP measurements will be collected from all of the monitoring wells.

Groundwater Sampling Procedures

For each sampling event, the groundwater level in each well will be measured to the nearest 0.01 ft with an electronic water-level meter. Groundwater-level measurements will be recorded after the well caps are removed and groundwater in the wells allowed to equilibrate for a minimum of 15 minutes. Temperature, pH, DO and ORP readings will be recorded in each well from which groundwater samples are collected. Three casing volumes of groundwater will be removed (or until dry) from each well with a submersible pump before sampling. Water pH, temperature, electric conductivity DO and ORP will be recorded during purging at intervals of approximately one casing volume. A water sample will be collected after water parameters have stabilized and the water level has returned to a minimum of 80% of the initially recorded water level.

Groundwater samples will be collected in new single-use disposable bailers fitted with disposable bottom-emptying devices to minimize water degassing for samples analyzed for volatile chemical constituents. The samples will be transferred to properly labeled, laboratory-supplied sterile sample containers, logged on a chain-of-custody form, and placed on ice for immediate transport to a State-certified laboratory. A field log presenting the water depth, the various water-quality measurements, and purge volumes will be recorded for each well sampled.

Following each quarterly sample event, a report of the event will be prepared and submitted to the CSDHS for their review. The reports will include monthly O&M data, DO and ORP measurements, groundwater-flow direction and gradient calculations, and analytical results. Water-level measurements, groundwater-sample results and the report will be electronically submitted to the State GeoTracker Internet Database.

SITE SAFETY PLAN

The attached Site Safety Plan (Appendix A) identifies the chemicals and other potential safety hazards that may be encountered, describes precautionary measures to be taken when in the presence of these chemicals and other potential safety hazards, and contains a map to the nearest medical facility.

SCHEDULE

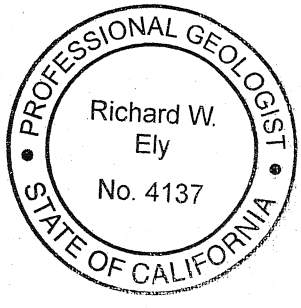
EC&A will schedule site work upon approval of this RAP by the CSDHS. EC&A anticipates conducting the slug test and four- to six-hour HVDPE pilot test within one month following approval of the RAP. The ozone/hydrogen peroxide system will require approximately 60 days for assembly and delivery. EC&A anticipates that field work can be completed and the system installed and operational within 90 to 120 days following approval of the RAP.

Thank you for allowing EC&A to provide environmental services for you. Please call John Calomiris, project manager, if you have any questions.

Sincerely,

John Calomiris
Technical Operations Manager

Richard Ely, PG #4137
Senior Geologist

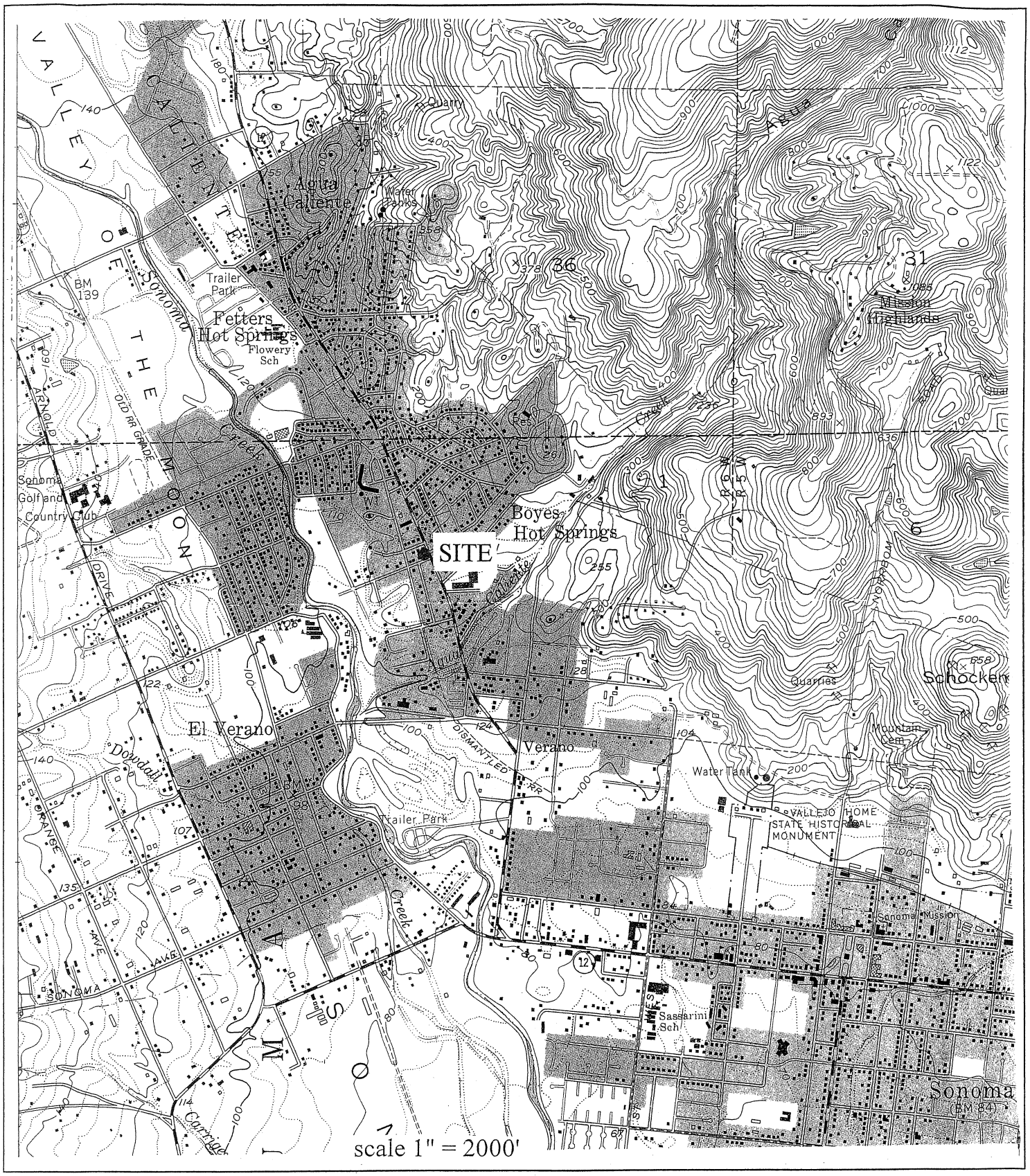


Attachments Figure 1 - Site Location Map
Figure 2 - Site Area Map
Figure 3 - Site Plan with Proposed Ozone Sparge Wells
Figure 4 - Typical Sparge Well Construction Diagram
Figure 5 - Typical Sparge Well Piping Construction Diagram
Figure 6 - Typical Ozone Process and Instrumentation Diagram

Appendix A - Site Safety Plan

cc: Dale Radford, County of Sonoma Department of Health Services

0268\2008 RAP

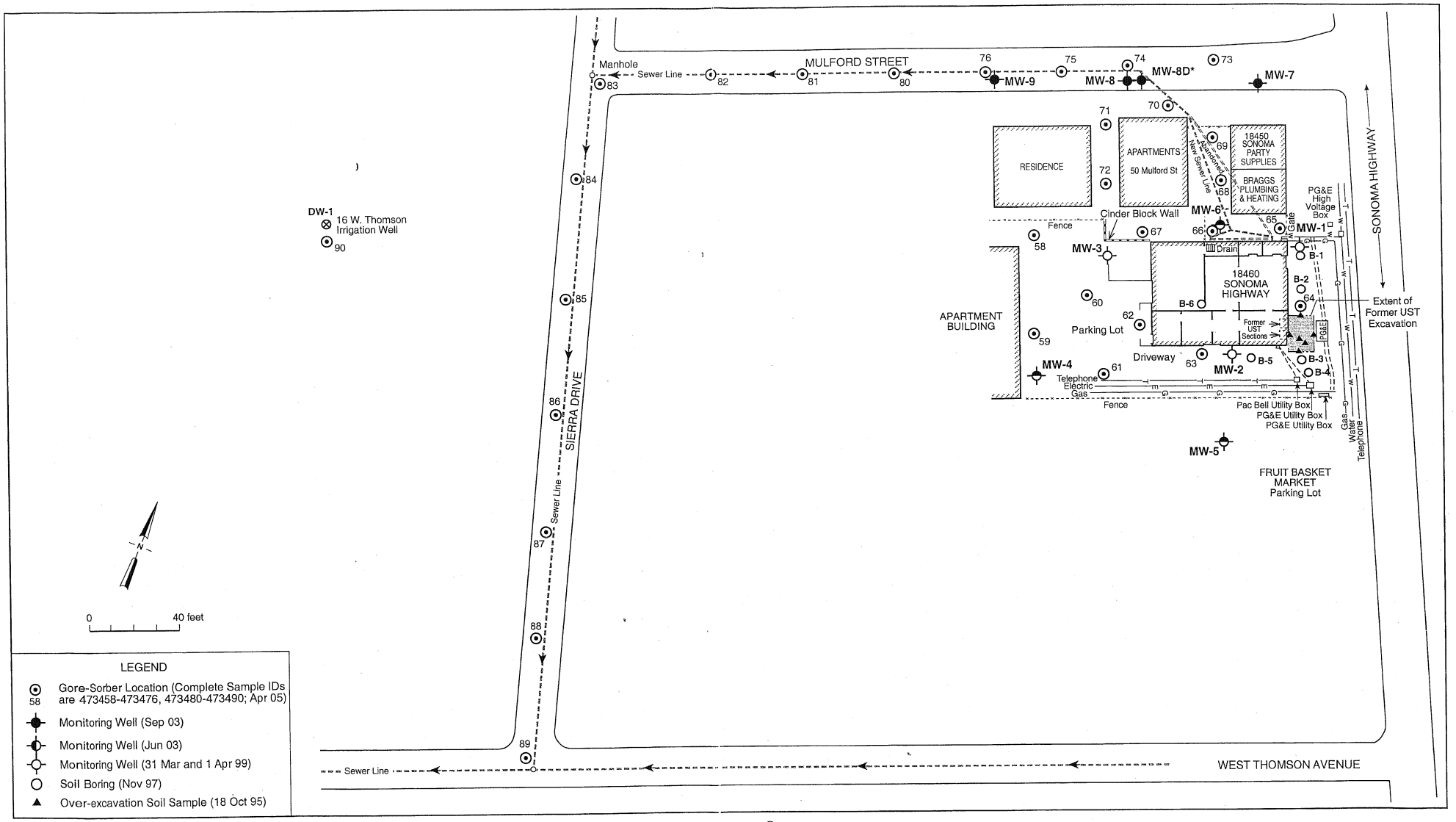


EDD CLARK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

Site Location Map
18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
0268,002.96	R. Ely	August 2004	



(TRACE #319/RGI/05Dec06)

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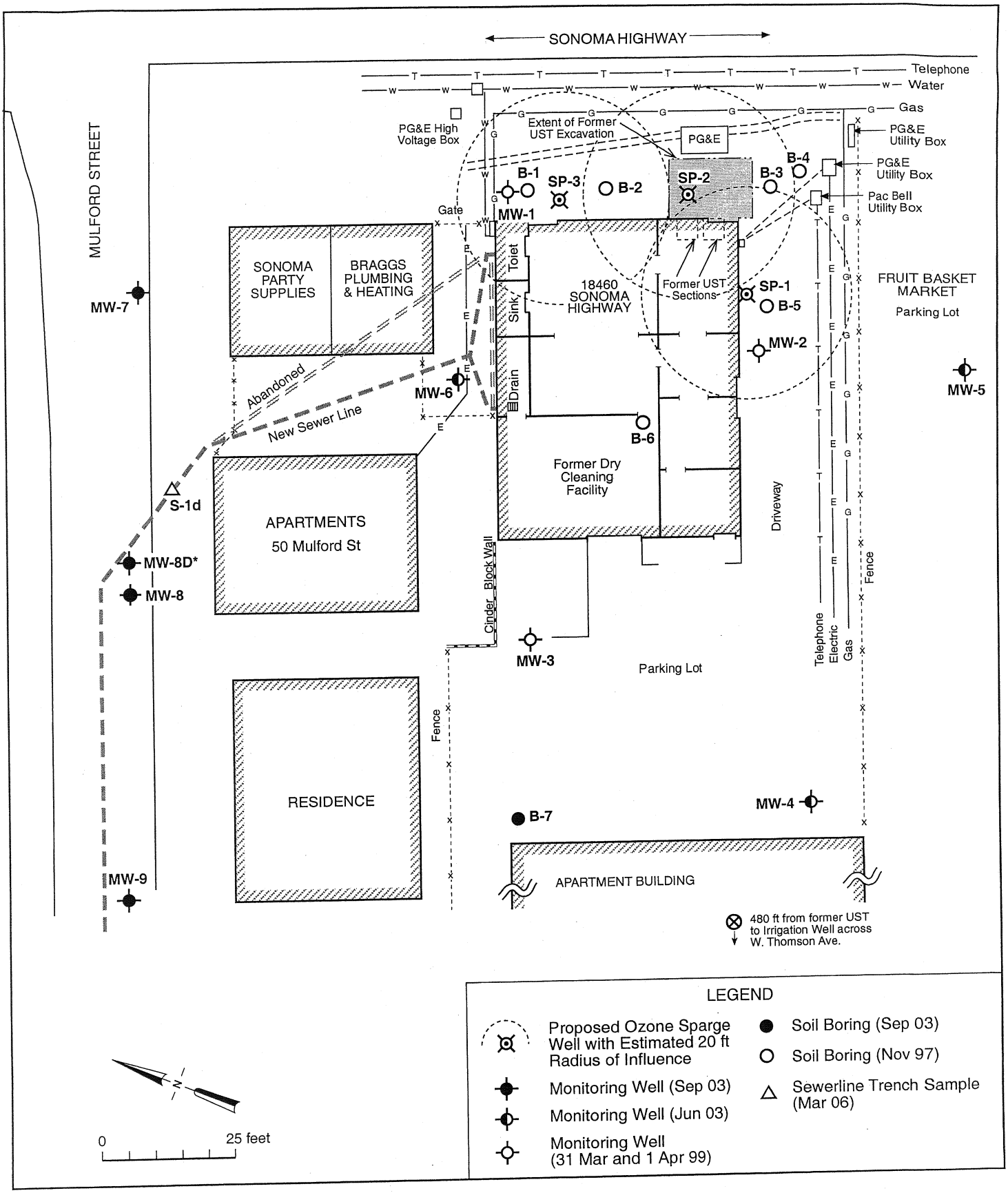
SITE AREA MAP
18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
0268, 002.96	EC&A, Richard Ely	April 1998	November 2006



(TRACE #319/RG/18Sep07)

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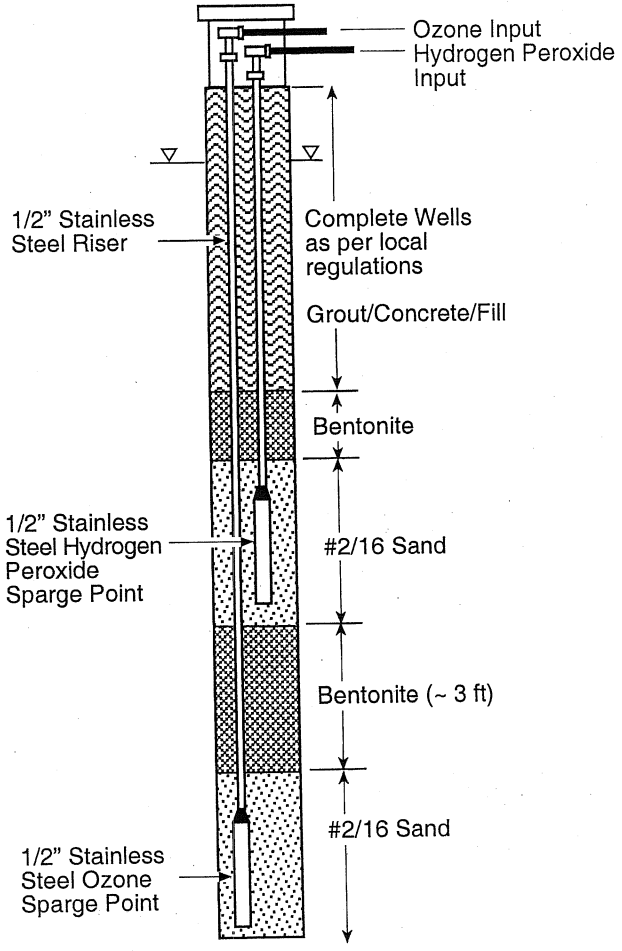
SITE PLAN
with Proposed Ozone Sparge Wells
18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE
3

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
0268, 002.96	EC&A, Richard Ely	April 1998	September 2007



DUAL POINT OZONE/PEROXIDE
SPARGE WELL

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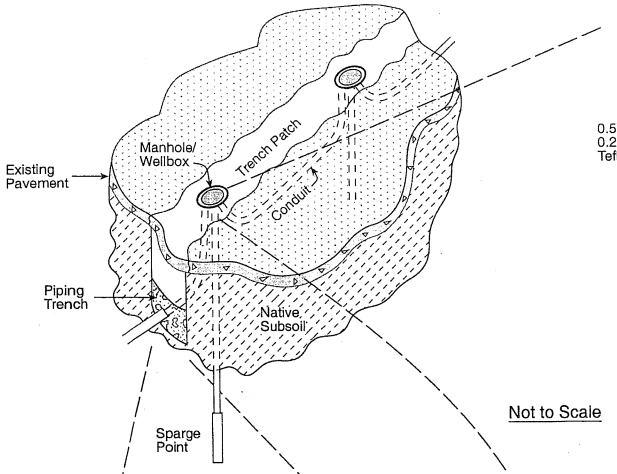
TYPICAL SPARGE WELL
CONSTRUCTION DIAGRAM
18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE
4

(TRACE #319/RG/18Sep07)

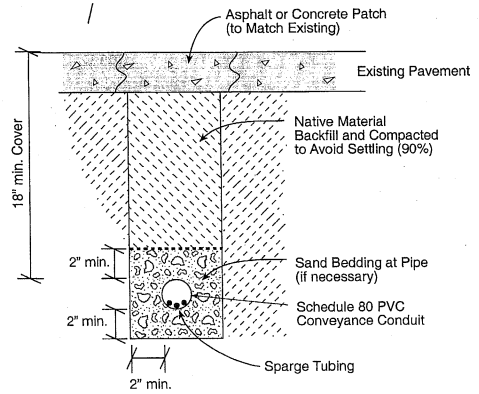
JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
0268, 002.96	EC&A, Richard Ely	September 2007	

A:
PIPING/TRENCH LAYOUT
(Perspective View)

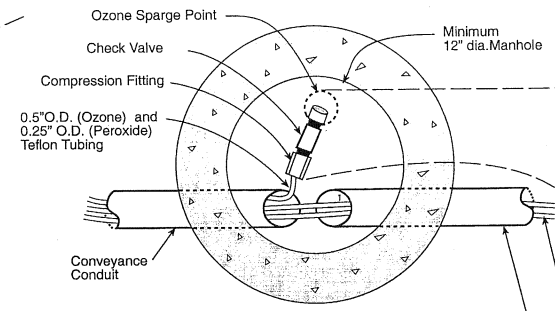


Not to Scale

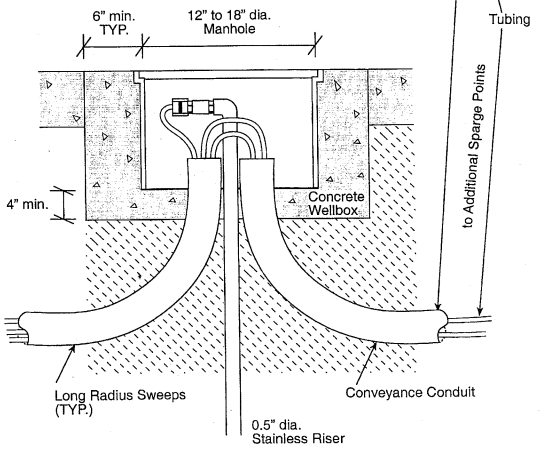
B:
TRENCH DETAIL - IN PAVEMENT
(Section View)



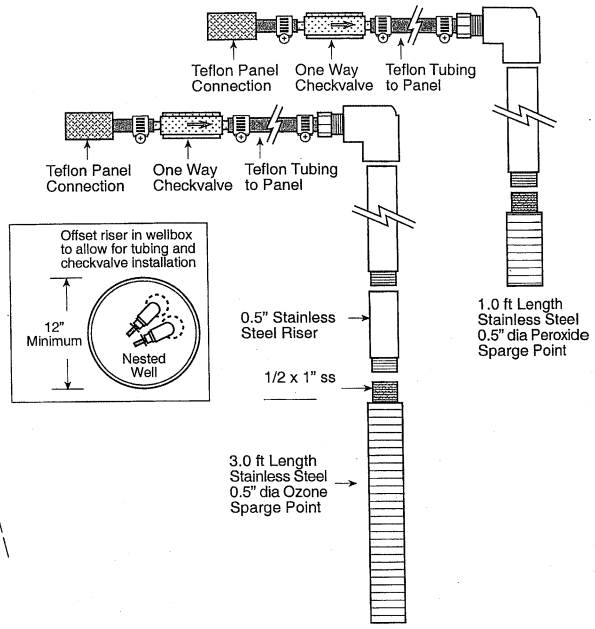
C:
WELLBOX CONNECTION DETAIL
(Plan View)



D:
WELLBOX CONNECTION DETAIL
(Section View)



E:
CAP ASSEMBLY DETAIL
(Dual Point Ozone/Hydrogen Peroxide)



Not to Scale

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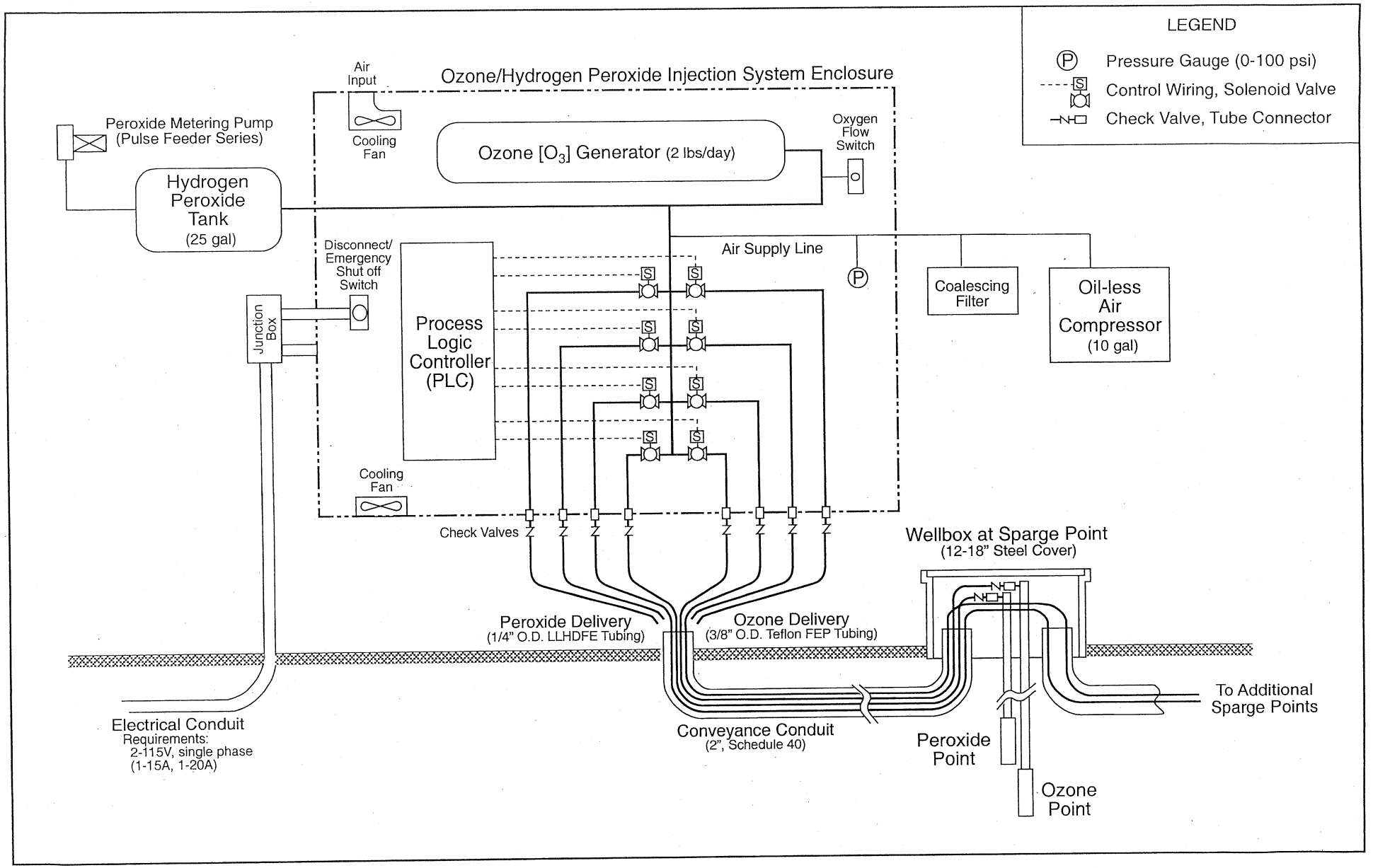
TYPICAL SPARGE WELL PIPING CONSTRUCTION DIAGRAM
18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE 5

(TRACE #319/RG/19Oct07)

JOB NUMBER	REVIEWED BY	DATE	REVISED	SHEET NO.
0268,002.96	EC&A, Richard Ely	September 2007	October 2007	1 of 1



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TYPICAL OZONE PROCESS AND INSTRUMENTATION DIAGRAM

18460 Sonoma Highway
Boyes Hot Springs, California

FIGURE
6

(TRACE #319/RG/18Sep07)

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
0268, 002.96	EC&A, Richard Ely	September 2006	

Appendix A

Site Safety Plan

A. GENERAL INFORMATION

Site Location: 18640 Sonoma Highway, Boyes Hot Springs, California

Plan Prepared By: Richard Ely Date: September 17, 2007

Objective(s): Conduct an 8-hour HVDPE pilot test to assess vapor yields from the formation and the potential for PCE vapors to migrate into the south side of the site building, and a three-month ozone/hydrogen peroxide microsparging pilot test to determine whether ozone and hydrogen peroxide injection could effectively remediate TPHg, benzene and 1,2-DCA impacted areas in soil below the water table.

Background Review: Complete: X Preliminary:

Documentation/Summary: Overall Hazard: Serious: Moderate: Low: X Unknown:

Unusual Features (power lines, terrain, utilities, etc.): Buildings, power lines, underground utilities.

STATUS: Active: X Inactive: Unknown:

HISTORY: (Agency Action, Complaints, Injuries, etc.) There has been a release of FHCs from two 1000-gallon USTs for gasoline that were removed from the site August 1995. There has also been a release of VOCs from a dry cleaning facility that was formerly located in the northwest corner of the building. EC&A's May 29, 2007 FS/CAP recommended HVDPE and ozone microsparging with hydrogen peroxide to remediate FHC-impacted soil and groundwater at the site, and proposed conducting HVDPE and ozone/hydrogen peroxide pilot tests to assess the potential for these methods to be effective remedial methods. In their letter dated June 28, 2007, the CSDHS concurred with these recommendations and requested submittal of a RAP to provide details for implementing the proposed scope of work.

B. SITE WASTE CHARACTERISTICS

Waste Type(s): Liquid: X(water) Solid: X(soil) Sludge: Gas:

Characteristic(s): Corrosive: Ignitable: Radioactive: Volatile: X
Toxic: X Reactive: Unknown Other (name): Flammable

Facility Description: A cell phone business occupies part of the building

Principle Disposal Method (type and location): Rinsate from decontamination procedures will be contained in 55-gallon drums for later disposal. Drill cuttings from the borings will be placed on and covered with plastic sheeting. Recommendations for treatment/disposal of waste materials will be submitted following evaluation of the analytical results of the soil and groundwater samples collected from the borings.

C. HAZARD EVALUATION

Chemical Name	Description	Threshold Limit Values (TLVs)		Persons Exposed and Potential Routes of Exposure	Symptoms of Acute Exposure	TLV Basis
		8-hr TWA	Short-term Exposure Limit (STEL)			
Benzene	Carcinogen, aromatic HC	0.5 ppm	2.5 ppm	Inhalation, dermal, Ingestion	Headache, dizziness	Cancer
Toluene	Aromatic HC	50 ppm	—	Inhalation, dermal, Ingestion	Headache, dizziness	Central nervous system (CNS), irritation
Ethyl-benzene	Aromatic HC	100 ppm	125 ppm	Inhalation, dermal, Ingestion	Headache, dizziness	Irritation, CNS
Xylenes	Aromatic HC	100 ppm	150 ppm	Inhalation, dermal, Ingestion	Headache, dizziness	Irritation
Gasoline	Flammable liquid	300 ppm	500 ppm	Inhalation, dermal, Ingestion	Headache, dizziness	Irritation, CNS
Tetrachloro-ethene (PCE)		25 ppm	100 ppm	Inhalation, dermal Ingestion	Eye, nose, throat, skin irritation, nausea, flushed face, vertigo	Irritation; CNS
Trichloro-ethene (TCE)		50 ppm	100 ppm	Inhalation, dermal Ingestion	Headache, vertigo, visual disturbance, nausea	CNS; headache; liver
1,2-Dichloro-ethene (DCE)		200 ppm	—	Inhalation, dermal Ingestion	Irritated eyes, respiratory system, central nervous system, depressant	Liver

SPECIAL PRECAUTIONS AND COMMENTS: Follow standard safety procedures for working around heavy equipment. Stand out of reach of drilling equipment. Verify that all equipment is in good condition. Use face shield when steam cleaning equipment. Conduct air monitoring to evaluate respiratory and explosion hazards. There will be no eating, smoking or drinking on site.

D. SITE SAFETY WORKPLAN

Perimeter Establishment: Map/Sketch Attached: X Site Secured: X
Perimeter Identified: X Zone(s) of Contamination Identified: X

Personal Protection:
Level of Protection: A: B: C: D: X

Modifications: Upgrade to level C upon high OVA readings (5 ppm)

Surveillance Equipment and Materials:
Instrument: OVA Action Level: 5 ppm

SITE PROCEDURES: Conduct an 8-hour HVDPE pilot test. Install three sparge wells, collect grab-groundwater samples from the wells, trench, plum and install sparge well panel, conduct a three-month ozone/hydrogen peroxide pilot test.

HAZARDS: Potential hazards onsite comprise proximity to drilling equipment, exposure to explosive and flammable petroleum vapors and carcinogens.

LEVEL OF PROTECTION: Equipment to protect the body from contact with chemical hazards has been categorized by the Environmental Protection Agency into levels A, B, C, & D. Level A equipment is used when the highest level of protection is needed; Level D equipment is used when minimum protection is needed. The chemical hazard associated with petroleum hydrocarbons is typically low and Level D protection (see equipment list below) is adequate. In case of high levels of contamination, an upgrade to Level C protection equipment may be advised. Level C and D equipment are listed below.

Level C Equipment: NIOSH/MSHA approved air purifying respirator, chemical resistant clothing, chemical resistant inner and outer gloves, chemical resistant boots with steel toe and shank, safety glasses and hard hat.

Level D Equipment: Coveralls, gloves, chemical resistant boots or shoes with steel toe and shank, safety glasses or chemical splash goggles, and hard hat. Tyvex overalls and Solvex or equivalent gloves are recommended.

EQUIPMENT REQUIRED FOR THIS PROJECT: Normal work clothing and safety glasses may be worn for site work. Wear neoprene boots if walking in or around waste soils. Surgeon's gloves, neoprene boots, and safety glasses are required when sampling. Upgrade to Level C includes addition of NIOSH/MSHA approved air purifying respirator with organic vapor cartridges.

A First Aid Kit, fire extinguisher, and OVA are required. The OVA is to be used to monitor air in breathing zone. Readings above 5 ppm are cause for concern. Continuous reading of 5

ppm or greater above background in the breathing zone requires an upgrade to Level C, including use of half-face respirator. Continuous readings of 50 ppm or greater in the breathing zone requires stopping the work.

DECONTAMINATION PROCEDURES:

Personal: Remove gloves, wash hands; steam clean boots in decontamination area.
Equipment: Steam cleaning of all excavation and drilling equipment in the decontamination area. TSP wash of sampler between samples.

FIRST AID: Consultants vehicle has a first aid kit.

WORK LIMITATIONS (time of day, weather, heat/cold, stress): None

INVESTIGATION-DERIVED MATERIAL DISPOSAL: Soil and groundwater -to be determined based on analytical results; decontamination solutions - store in 55-gallon barrels; protective clothing - drums, except boots.

E. EMERGENCY INFORMATION

LOCAL RESOURCES:

Ambulance: 911
Hospital Emergency Room: Sonoma Valley Hospital
347 Andrieux Street
Sonoma, California
(707) 935-5000

Poison Control Center: 911
Police: 911
Fire Department: 911
Explosives Unit: 911
Agency Contact: Dale Radford, County of Sonoma Department of Health Services
(707) 565-6573

SITE RESOURCES:

Water Supply: Onsite
Telephone: Onsite
Radio: None
Other:

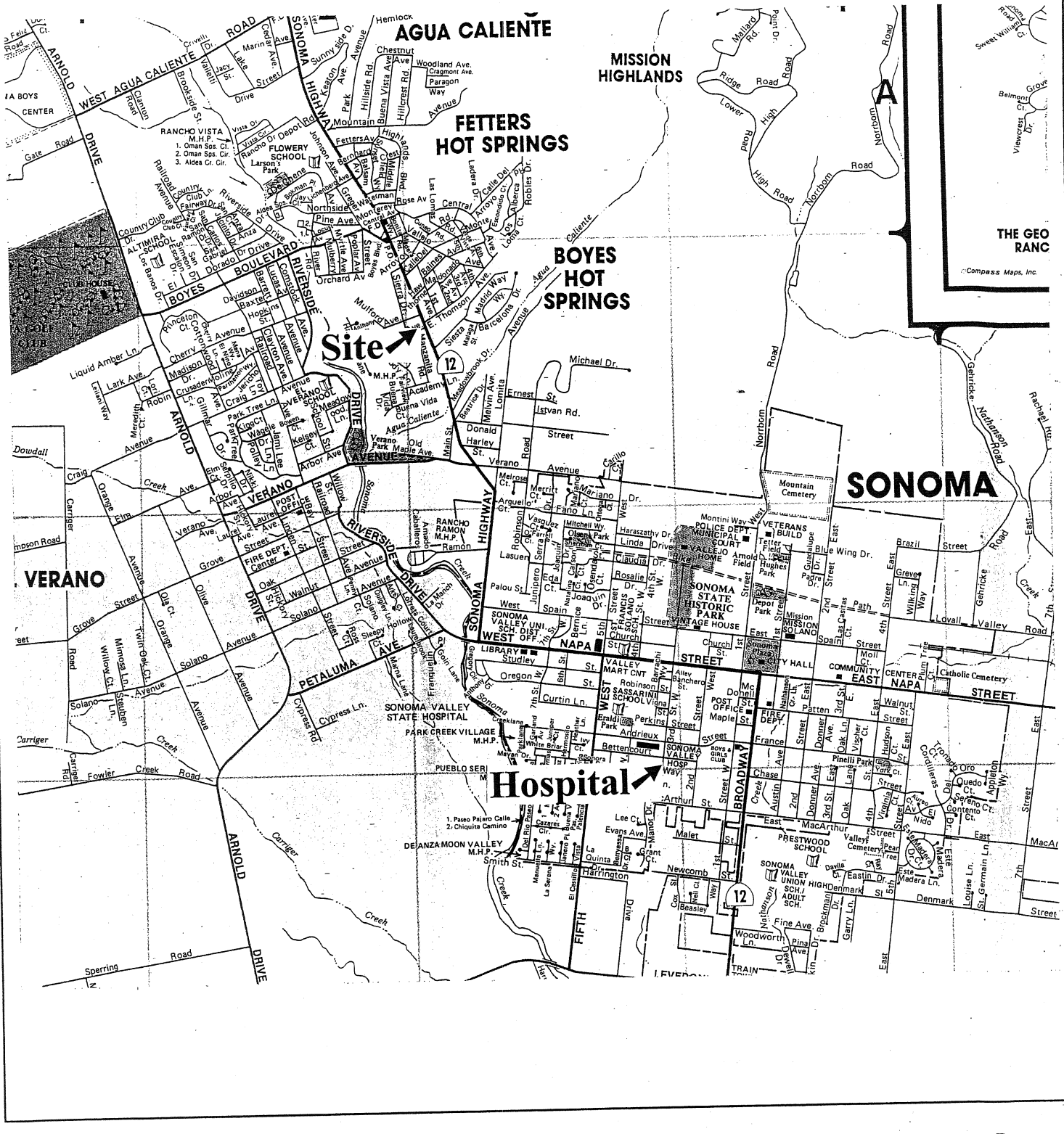
EMERGENCY CONTACT:

Name: John Calomiris
Phone: (707) 792-9500

EMERGENCY ROUTE: See Plate H

SITE SKETCH: (Work zones, command post, etc.): See Workplan

Signature Date



EDD CLARK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

Hospital Location Map
Sonoma Valley Hospital
347 Andrieux
Sonoma, California

PLATE
H

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
0268,001.96		08/98		